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PRESERVATION OF NIAGARA FALLS.

Mr. CULLOM presented the following

HEARINGS BEFORE THE COMMITTEE ON FOREIGN RELATIONS IN REGARD TO THE PRESERVATION OF NIAGARA FALLS.

APRIL 21, 1906.—Ordered to be printed.

COMMITTEE ON FOREIGN RELATIONS,
UNITED STATES SENATE,
Washington, D. C., April 11, 1906.

The committee met at 10.30 a. m.

Present: Senators Cullom (chairman), Frye, Lodge, Foraker, Kean, Morgan, Bacon, Money; Clark, of Montana, and McCreary.

Mr. Isham G. Randolph and Mr. Robert R. McCormick appeared before the committee.

The CHAIRMAN. The message of the President, containing certain recommendations relating to the preservation of Niagara Falls, was referred to the Committee on Foreign Relations on March 27, and is now pending before us. That message is accompanied by the report of the International Waterways Commission, appointed in pursuance of resolution of Congress, in which it is recommended that, pending the negotiation of a treaty with Great Britain, legislation be enacted limiting the diversion of waters tributary to Niagara Falls to 28,500 cubic feet per second, of which amount the Chicago Drainage Canal is to be permitted to use 10,000 cubic feet per second. The report of the International Waterways Commission was brought to the attention of officials of the sanitary district of Chicago, under whose supervision the drainage canal is being operated. The officials of that district contend that they should not be limited to 10,000 cubic feet per second. The president of the district, Mr. McCormick, communicated with me some days ago and asked that he be given a hearing before this committee. On the part of the committee I took the liberty of inviting him to appear here to-day.

Mr. McCormick and the chief engineer of the Chicago Drainage Canal, Mr. Randolph, are now before the committee prepared to submit their statements.

Senator MONEY. Are there not two questions in regard to this waterway—one in regard to the Illinois River, and the other in regard to the commercial problem?

The CHAIRMAN. The Chicago Drainage Canal is supplied from the waters of Lake Michigan, and the question is whether that diversion lowers the water of Lake Michigan to such an extent as to have an appreciable effect on the flow of water passing over Niagara Falls.

We will now hear Mr. McCormick, who represents the sanitary district of Chicago as its president.

STATEMENT OF ROBERT R. McCORMICK, PRESIDENT OF THE SANITARY DISTRICT OF CHICAGO.

Senator FORAKER. You are a member of that board, are you, Mr. McCormick?

Mr. MCCORMICK. I am president of the board.

Senator FORAKER. What is the name of that board?

Mr. MCCORMICK. The sanitary district of Chicago, a municipality.

Senator FORAKER. Is it a board created by State statute, or by an ordinance?

The CHAIRMAN. By a State statute.

Mr. MCCORMICK (in reply to Senator Bacon). The map you have before you does not show the boundaries of the district. I think we have a map that does.

Senator FORAKER. That does show the locality from Lake Michigan.

Mr. MCCORMICK. It shows where the canal is now running. This is a map of the present canal, and this one of the proposed canal.

The CHAIRMAN. Go on, Mr. McCormick.

Mr. MCCORMICK. Perhaps I might state, Senator, for the information of the members of the committee, what the sanitary district is. In a word, it is a municipality which embraces all of Chicago and a good deal of the surrounding territory, which territory is taxed for the work done by the district, all of which is drainage work. It is governed by trustees elected by the people.

The CHAIRMAN. For general information you might state how much money you have spent there.

Mr. MCCORMICK. We have spent over $48,000,000, have we not, Mr. Randolph?

Mr. RANDOLPH. Forty-nine million dollars and some hundred thousand.

Mr. MCCORMICK. And we will have to spend nearly $16,000,000 more.

Senator FORAKER. You have spent $49,000,000 on this drainage canal, that is marked as the principal canal?

Mr. MCCORMICK. Yes, sir.

Senator FORAKER. This part indicated here, leading down to Lake Calumet, has not yet been constructed?

Mr. MCCORMICK. No. We are working on that now—planning to raise the money and buying the right of way.

Senator FORAKER. You have spent part of the $49,000,000 on that, have you, or all of it on the other?

Mr. MCCORMICK. We have spent it on the new work in one sense. There [pointing] is the old Illinois and Michigan Canal, and before we can construct the Calumet Canal we have to make a substitute for the Illinois-Michigan Canal by building a lock at Joliet and connecting our canal with the old one there, and we are spending money on that work.

Senator FORAKER. What river is it at Joliet?

Mr. MCCORMICK. The Desplaines, as far as you see it. It empties into the Illinois River below.

Senator FORAKER. That empties into the Illinois?

Mr. MCCORMICK. It empties into the Illinois about 20 miles south of Joliet.

Senator LODGE. And then goes to the Mississippi?

Mr. MCCORMICK. Then it goes on to the Mississippi. It is quite a significant fact that where the Desplaines River, which carries the Chicago sewage, meets the Illinois the Desplaines is the cleaner of the two.

Senator FORAKER. Is that where the fish are?

Mr. MCCORMICK. There are a few fish there.

Senator FORAKER. I see that since they turned the sewage in there the fish have come back to live in the river. They made that point in the argument before the Supreme Court.

Mr. MCCORMICK. In the proposed limitation by the engineers they have classed together the Chicago Drainage Canal and two power corporations at Niagara Falls, and have recommended that the district—that is, Chicago—be limited to 10,000 cubic feet per second flow, and that one of the power companies be limited to 9,500 and the other one to 8,600.

The CHAIRMAN. Yes; here are the figures. This report is made by Ernst, Clinton, and Wisner, and it recommends that the Niagara Falls Hydraulic Power and Manufacturing Company be authorized to divert 9,500 cubic feet; the Niagara Falls Power Company, 8,600; the Erie Canal or its tenants, in addition to lock service, 400, and the Chicago Drainage Canal, 10,000.

Mr. MCCORMICK. Ten thousand is not enough to conserve the health of Chicago and the flow through the Illinois Valley to the Mississippi.

We do not want to appear to take the position of preventing legislation to help Niagara Falls. I think Chicago people probably see more of Niagara Falls than Boston people do, Senator Lodge, because they go to Boston more often than your people come our way, and they stop at Niagara on the way; but we do think that the health of the people and the commerce of the Mississippi watershed ought to be put before the beauty of the falls, and that it ought not to be classed on a par with a purely profit-making corporation.

If it had been possible to avoid it, we never would have dug this canal. Nobody wanted to dig it. It has already cost us $50,000,000. We did not want to spend the money, but it was the only way engineers could devise to drain Chicago. In the old days, when sewage went out in the lake, it came back in the drinking water and caused a typhoid epidemic every year, so the drainage canal was dug. It has cost nearly $50,000,000 to-day, and, as I have said, must cost $15,000,000 more to complete.

Senator FORAKER. What are the dimensions of that canal?

Mr. MCCORMICK. The dimensions vary in different places, according to the structure of the soil. Through the solid-rock cuts it is 160 feet wide by 22 feet deep.

Senator FORAKER. Where is that?

Mr. MCCORMICK. I wish Mr. Randolph would show that.

Mr. RANDOLPH. That begins at Willow Springs and extends 14.95 miles to Lockport.

The CHAIRMAN. And it will not be extended?

Mr. RANDOLPH. We are extending that channel 4 miles.

The CHAIRMAN. That is rock also, is it not?

Mr. RANDOLPH. That is, between walls. Part of it is through rock but a good portion of it is between walls.

Senator MONEY. This is intended as a navigable canal as well as a drainage canal?

Mr. RANDOLPH. Yes, sir.

Senator BACON. Is it navigated?

Mr. RANDOLPH. It is navigable.

Senator BACON. It is navigable, but is it practically navigated?

Mr. RANDOLPH. It is principally used by the people in the stone business.

Senator BACON. You speak of this particular section being 22 feet. What is the shallowest part?

Mr. MCCORMICK. Twenty-two feet is the shallowest part of the canal anywhere.

Senator MONEY. Do you mean the water would be 22 feet deep?

Mr. MCCORMICK. It is 22 feet to-day.

Senator MONEY. That is as much as any canal boat will draw.

Senator LODGE. That is a great depth, of course.

Senator FORAKER. I see one point there marked "summit." That is not a very high altitude, I suppose, is it?

Mr. MCCORMICK. That is the summit between Lake Michigan watershed and the Desplaines watershed.

Senator FORAKER. It is not very high, is it?

Mr. MCCORMICK. No; only a few feet.

Senator FORAKER. There is no lock in the canal, is there?

Mr. MCCORMICK. Not a lock; no, sir. It is all gravity flow.

The canal is being built in four sections, the first of which is already completed. The rock cut Senator Foraker spoke of is completed in its entirety, because when the district was digging the rock section it appeared advisable to build for all time.

Senator FORAKER. Is it simply solid rock?

Mr. MCCORMICK. Most of it is "rock wall," and in some places it is riprap, as you can see by this picture. Up to Willow Springs it is finished for all time, and has a capacity for 14,000 cubic feet per second, the amount we ask for. The money has been spent to provide for that amount.

Senator BACON. Is this a picture of the rock cut?

Mr. MCCORMICK. Yes, sir.

Senator BACON. Before the water was turned in?

Mr. MCCORMICK. Before the water was turned in.

Senator BACON. That is what I thought.

Mr. MCCORMICK. In the earth sections they figured it would be cheaper to put in what flow was needed then, and as the demand increased to widen the canal by dredging. The first division is finished now, which accommodates a flow of 6,000 cubic feet in the main branch of the Chicago River, down the south branch, and through the canal. An intercepting sewer has been built at Thirty-ninth street, Chicago, to take the sewage of the southern section of the city over to the canal. It will add another 200,000 cubic feet, making 800,000 cubic feet of flow down the canal.

The CHAIRMAN. You are not actually using at present the amount that this report would give you?

Mr. MCCORMICK. No, sir; and we will not for some years; but we know that a treaty with England is something that can not be turned over at will. In a treaty we should be provided for for all time.

Senator FORAKER. This legislation is only proposed subject to treaty, of course?

Mr. MCCORMICK. Yes, sir.

The CHAIRMAN. The object of the report is to get a bill passed to last for two years.

Senator LODGE. Yes; to last for three years; and if the treaty is made sooner the legislation lapses.

Senator MCCREARY. Mr. Chairman, will you now state, if you please, the question before the committee? I have just come in.

The CHAIRMAN. You will find the basis of the action proposed to be taken now is in this report of the American members of the International Waterways Commission, limiting the amount of water supply to be taken from Niagara Falls—for instance, by the Chicago Drainage Canal, to 10,000 feet per second, is it not?

Mr. MCCORMICK. That is the proposed limit. We are asking to have it raised to 14,000 cubic feet per second.

Senator MCCREARY. And we are looking to the preservation of Niagara Falls?

The CHAIRMAN. Yes; and at the same time not cutting off Chicago, which has been digging a canal at a cost of $50,000,000, from its right to a sufficient amount of water in that canal for all purposes hereafter.

Senator MONEY. How far is it from Chicago to Niagara Falls?

Mr. MCCORMICK. By water, I do not know. I think it is about 700 miles by rail.

Senator LODGE. It reduces the amount of water going over the falls.

Senator MCCREARY. The water you desire is from Lake Michigan, I suppose?

Mr. MCCORMICK. Yes; the southern end of Lake Michigan.

Senator LODGE. The report says:

> Works are now authorized and partially completed at the falls which will divert from the Niagara River, above the falls, about 27 per cent of the average discharge and about 33 per cent of the low-water discharge, which is more than double the quantity now flowing over the American fall.

Senator BACON. What is the current or the rapidity of the Chicago Canal?

Mr. MCCORMICK. The War Department has limited the current of the Chicago River to 1¼ miles an hour.

Senator BACON. You say it has limited it to that?

Mr. MCCORMICK. Yes; it does not allow us to cause a greater current than 1¼ miles an hour in the Chicago River.

Senator BACON. They do not permit you to so operate your canal as to create a current of greater rapidity than 1¼ miles an hour?

Mr. MCCORMICK. No, sir.

Senator BACON. Because formerly the current was in the opposite direction?

Mr. MCCORMICK. There was practically no current. At certain seasons there was a current toward the lake.

Senator FORAKER. Are you building the drainage canal under some act of Congress?

Mr. MCCORMICK. No, sir; under a right from the State of Illinois.

Senator FORAKER. That is what I have always understood; but how does the Secretary of War have anything to do with it?

Mr. McCORMICK. Because the Chicago River is a navigable stream. If we made too rapid a flow of water down the Chicago River, it would interfere with commerce.

The CHAIRMAN. And take more water per second out of the lake?

Mr. McCORMICK. Yes, sir.

Senator MONEY. I introduced a bill this session providing for a waterway down the canal and on into the Mississippi River in the interest of communication, not in the interest of drainage. At that time we did not have any romantic views about Niagara Falls. We did not think it was going to interfere with Niagara Falls. In fact, we were not thinking of it at all.

Senator LODGE. According to this report, if the committee will permit me to read it, the total quantity of water to be taken from the river by works now authorized—they are not all completed—amounts to 60,900 cubic feet per second:

> Of this amount, 26,700 cubic feet is to be taken on the American side and the remainder, 34,200 cubic feet, on the Canadian side—that is, 27 per cent of the average discharge and 33 per cent of the low-water discharge of the Niagara River will cease to pass over the falls when these works are completed and in full operation. The quantity to be diverted is more than double the quantity which now passes over the American fall, which, at the average stage, is about 27,800 cubic feet. That this will, in general, have an injurious effect upon the falls seems self-evident. The volume of water to be diverted is about the equivalent of the entire discharge of Lake Superior over the Sault Ste. Marie. The amount thus far actually diverted is but 17,800 cubic feet per second, and has had an appreciable effect upon the falls. To foretell with accuracy the effects in detail of the full diversion authorized would require a more complete knowledge of the bed of the river than is now obtainable. The water taken on the Canadian side below the crest of the rapids will affect the horseshoe fall alone. If all that taken on the American side should affect the American fall alone it would practically leave it dry.

The CHAIRMAN. Beginning at page 17, there are two pages of manufacturing establishments that are proposing to take advantage of the falls, and, of course, if everybody's manufacturing establishment relies on the falls it would be dry.

Senator LODGE. The falls would be gone. Of course they do not propose to stop the operation of the Chicago Drainage Canal. It is only a question of the amount of water to be allowed.

Mr. McCORMICK. I am suggesting that we should not be put on a par with these manufacturing companies. To finish our scheme, on which $50,000,000 has already been spent, to get the absolutely necessary flow from South Chicago for the diversion of the Calumet River, will take 4,000 cubic feet——

Senator BACON. You are going to put that canal here [indicating]?

Mr. McCORMICK. Yes, sir; the red line there. It will reverse the Calumet River.

Senator McCREARY. What is the length of the canal?

Mr. RANDOLPH. The finished portion is 28.05 miles. We are extending that now 4 miles farther. The Chicago River, taken in connection with what we have already done, makes 34 miles of navigable channel.

Senator FORAKER. That is, from Lake Michigan to Lockport?

Mr. RANDOLPH. To Lockport.

Senator FORAKER. Is 34 miles?

Mr. RANDOLPH. Yes, sir.

Senator FRYE. Mr. McCormick proposes that we allow the canal to take more than the board recommends.

The CHAIRMAN. They want the amount to be increased to 14,000 cubic feet per second.

Mr. MCCORMICK. Fourteen thousand, exclusive of lockage.

Senator BACON. Is this canal to be extended to the Calumet River?

Mr. MCCORMICK. Yes, sir.

Senator BACON. That is not navigable?

Mr. MCCORMICK. It will be. It is navigable part way now. Congress has spent a good deal of money upon it. It is navigable, but I do not know how far up.

Mr. RANDOLPH. It is navigable now to Chittenden Bridge, and appropriations have been made for still further improvements.

Senator LODGE. The report excepts service of the locks, I see.

Mr. MCCORMICK. Our case is not mentioned, I think. The Erie Canal and the Welland Canal are mentioned.

Senator Lodge. The report says:

As a step in that direction we recommend that legislation be enacted which shall contain the following provisions, viz:

(*a*) The Secretary of War to be authorized to grant permits for the diversion of 28,500 cubic feet per second, and no more, from the waters naturally tributary to Niagara Falls, distributed as follows:

	Cubic feet.
Niagara Falls Hydraulic Power and Manufacturing Company	9,500
Niagara Falls Power Company	8,600
Erie Canal or its tenants (in addition to lock service)	400
Chicago Drainage Canal	10,000

(*b*) All other diversion of water which is natural to Niagara Falls to be prohibited, except such as may be required for domestic use or for the service of locks in navigation canals.

Mr. MCCORMICK. I had not noticed that.

Senator LODGE. That would cover that point, of course, because yours is going to be a navigation canal as well as a drainage canal. So that would except your locks.

Mr. MCCORMICK. Yes; I had not noticed that before.

There is a bill pending in Congress now for a deep waterway from Chicago to St. Louis——

Senator FRYE. Has any ascertainment been made as to how much that would reduce Lake Michigan?

Mr. MCCORMICK. Mr. Randolph can answer that. I think he says not at all.

Mr. RANDOLPH. That question has been under discussion for a great many years. The suit of St. Louis compelled us to open this channel in the winter months, in January, when the Lakes are at their lowest state. Observations extending over forty-odd years show that the Lakes are something like a foot higher in midsummer than in the winter months. We opened this channel on the 17th of January, 1900. After that the lake rose to its maximum the following summer. There has been a period of high water in the Lakes ever since. There is a theory that the high water in the Lakes comes in cycles of fourteen years, an ascending scale for seven years and a descending scale for seven years. We seem to be now on the ascending scale. The Lakes have been higher from the time we opened the canal up to the present time. This winter they have been unusually high for the winter season, so that we are evidently on the ascending scale. The only

guess that anybody has made is that the eventual lowering of the Lakes by this method will be possibly 6 inches; but no method which has been adopted yet has been able to determine that question, because of the oscillation of the Lakes. We have that at Chicago—an oscillation of as much as 4 feet in a day, owing to the wind.

Senator LODGE. Do you know whether they have calculated to show that this diminishes the water over the falls—that is, I mean taking out the actual diminution of the falls, taking out what may be accounted for by the local power company, that it then shows this diminution of the Chicago Drainage Canal?

Mr. RANDOLPH. No, sir; there has been no scientific demonstration of that fact at all; no scientific demonstration of the amount of water that passes from Lake Michigan into the St. Clair River.

Senator LODGE. That is what I wanted to get at.

Senator FORAKER. Has there been any indication of the diminution of the water in the channel of the St. Clair River?

Mr. RANDOLPH. There has not. There is no indication of that up to the present time.

Senator BACON. Has there been an investigation made to see whether or not that river has become smaller?

Mr. RANDOLPH. Yes, sir. The Government is having constant gauge readings taken. It has been having them for several years. The question is in the hands of the Engineer Department, with headquarters at Detroit.

Senator BACON. Naturally that would be the case under the conditions you mention, where the lake itself had not lowered. Of course if the lake had not been lowered by the withdrawal of the water for the Chicago Canal the St. Clair River water would not be lowered either.

Mr. RANDOLPH. No.

Senator BACON. But if the apprehension we now entertain, that ultimately it will result in the lowering to the extent of 6 inches, is realized, it must necessarily affect the St. Clair River in the same degree.

Mr. RANDOLPH. Certainly.

Senator BACON. That is the only supply of the St. Clair River, is it not?

Mr. RANDOLPH. The St. Clair takes its supply from Lake Superior, Lake Huron, and Lake Michigan.

The CHAIRMAN. Mr. Randolph, if Mr. McCormick is through I would like to have you take up this subject and make a statement in regard to it.

Mr. MCCORMICK. I would just like to finish what I have to say, gentlemen.

The CHAIRMAN. Finish what you have to say.

Mr. MCCORMICK. I think Mr. Randolph will show you in a moment that whatever flow we take down the canal alone is very small in comparison to the amount that goes through the St. Clair River, perhaps one-fifteenth of it. I have forgotten the figures. We have begun our work with the idea of flowing 14,000 cubic feet through the rock section. When the Chicago River is finished it will be flowing 8,000 cubic feet, which will come from as far north as Waukegan. It will take 4,000 to reverse the flow of the Calumet River and 2,000 to take care of the Thirty-ninth street sewer, making a total of 14,000, as

opposed to 10,000 suggested by the engineers and 9,500 proposed by them for a private power company.

Senator MONEY. Mr. Chairman, I would like to ask Mr. McCormick one or two questions before he leaves the stand.

The CHAIRMAN. Certainly.

Senator MONEY. Mr. McCormick, what is the water area of Lakes Superior, Huron, Michigan, St. Clair, and Erie?

Mr. MCCORMICK. I can not answer that.

Senator MONEY. Has anybody put anything before the committee that will show that?

The CHAIRMAN. It is likely Mr. Randolph can answer it.

Mr. RANDOLPH. I do not recall it now.

Senator MONEY. I ask that because the evaporation on that area must be enormous, and I want to make a calculation, or you engineers could do it, as to how much 4,000 more cubic feet per second would evaporate out of the whole surface. Here are two extreme points on the lake. It is not like taking out 4,000 feet as though it were taken out here at Niagara and diverted back this way. In other words, your 14,000 feet have to undergo the effect of your evaporation in going a distance of 2,000 miles, is it, by water, altogether?

Mr. RANDOLPH. No, sir; it is about 700 miles.

Senator MONEY. It is 700 miles by land, is it not?

Mr. RANDOLPH. About 576 miles by land from Chicago to Buffalo, and it must be about 800 by water.

Senator MONEY. That can not be right. The land transportation is almost a straight line. The water goes up here the whole length of Michigan, through the Straits of Mackinac, down through the St. Clair River, and then down through Lake Erie before you reach the Niagara River. It must be a tremendous distance.

The CHAIRMAN. You mean the distance the water travels before it reaches Niagara Falls?

Senator MONEY. Yes. I supposed somebody in studying this problem had estimated the amount of evaporation. Without having studied it all, at first blush I would say that the loss of ten, fourteen, or twenty thousand gallons (cubic feet?) a second, diverted here at this extreme point, would have no appreciable effect upon the discharge at Niagara, counting the evaporation.

Senator FORAKER. But is not evaporation determined by the area, and will not the area, after they have withdrawn the water for this drainage canal, be practically the same as it was before? Therefore, does evaporation enter into it at all?

Senator MONEY. I understand that. I do not want to take up too much time, but I am interested in commerce. A bill has been introduced to make a waterway for commercial purposes from Chicago to St. Louis. When it gets to St. Louis, then my State is provided for on the lower Mississippi. Senator McCreary's State is provided for, and a good many others. Here is an enormous lake going up this way and coming down this way, and so on down to Niagara. If there are 14,000 feet taken from this point——

Senator FORAKER. At Chicago?

Senator MONEY. At Niagara. And taken over here by some means and discharged, you would have a very appreciable effect upon Niagara Falls; but you take it off here——

Senator FORAKER. At the Chicago point?

Senator MONEY. At the Chicago point. I say that 14,000 will not be appreciable when you consider the evaporation over that extended area of water.

Mr. RANDOLPH. The evaporation is about one one-hundredth of a foot per day.

The CHAIRMAN. You may finish what you have to say, Mr. McCormick.

Mr. MCCORMICK. In considering the flow of water we must think of not only Chicago, but also the people down the Illinois Valley and down the Mississippi River. If Congress should limit us to a too small flow, then our water going down the canal would be a foul stream and create great hardship upon the people in the Illinois Valley. Probably it would give Missouri another cause for an injunction against us. You know, when the Supreme Court dismissed the petition for an injunction, it held that Missouri had shown no damage by means of our stream; but if we are not allowed to increase the size of the stream and yet increase the population, then a cause of action will arise, and Missouri will be allowed to enjoin Chicago and close up the canal.

Senator LODGE. Let me ask you another question, which is suggested to me by what this report says. It seems to me as if they did not intend to cut down the Chicago Drainage Canal. I mean they meant to allow enough for that, and the cutting was to come where I think it ought to come, on the power companies. They say:

> The Chicago Drainage Canal, constructed under the authority of the State of Illinois, was designed to divert about 10,000 cubic feet per second of water which would naturally flow over Niagara Falls. It has not been fully completed, but it now has a capacity of about 5,000 cubic feet per second. The amount which it is actually diverting has thus far been limited by the Secretary of War to about 4,200 cubic feet per second.

That would indicate that they thought when they allowed 10,200 cubic feet they were allowing all that was desired, because they say it was designed to divert 10,000 feet. I do not think their intention was to cut you down.

Mr. MCCORMICK. That is true. The original plan was for 10,000 feet, but when after developments showed that 14,000 feet were necessary the plan was changed.

Senator BACON. How much are you using now?

Mr. MCCORMICK. Between 5,000 and 6,000 feet.

Senator BACON. That raises a question I would like to ask Mr. Randolph. Is this estimate you speak of, regarding the ultimate effect on the water in Lake Michigan, reducing it 6 inches, based upon the present consumption or upon the 10,000 feet?

Mr. RANDOLPH. It is based upon the 10,000 cubic feet.

Senator BACON. With 14,000, the estimate, I suppose, would be somewhere between 8 and 9 inches?

Mr. RANDOLPH. Yes, sir; it would be in proportion.

Senator BACON. Do you not consider that pretty serious, reducing the surface of a large body of water like Lake Michigan 8 to 9 inches? That is an immense volume of water.

Senator KEAN. You would not do that in twenty-four hours?

Senator BACON. No; that would be the permanent effect. In other words, when the canal gets to running 14,000 cubic feet per second the effect upon that when it comes down to its regular operation

would be a permanent lowering, varied of course by the season and the water supply, the snows, etc., between 8 and 9 inches.

Mr. RANDOLPH. As I said before, gentlemen, there has been no scientific demonstration of that at all. It has been about the best guess anybody has been able to make on it.

Senator BACON. Do you think that is approximately correct?

Mr. RANDOLPH. No, sir; I do not. I do not believe it. I do not see how the withdrawal of 4½ per cent of the flow which passes through the St. Clair River can possibly have that effect. It is only taking about 4½ per cent.

Senator BACON. What is the estimate of the amount of water flowing through the St. Clair River?

Mr. RANDOLPH. It is approximately slightly over 200,000 cubic feet per second.

Senator BACON. This would amount to 4½ per cent of it?

Mr. RANDOLPH. Yes.

Mr. MCCORMICK. Senator Money, and Congressman Madden, of Chicago, have introduced bills into Congress for a deep waterway, and any limit you put on water for the canal will be a limit on the waterway, a waterway which will affect not only the Illinois Valley and the Mississippi River, but all the navigable streams that are running into the Mississippi River. We believe the waterway is a perfectly feasible scheme, and think it would be too bad that the success of such an undertaking should be limited by means of a treaty with England.

I want to repeat that the Chicago Drainage Canal is a drainage proposition. It is not a matter of putting private gain over the public good at Niagara. It is the only way to preserve the health of Chicago and to have a clean flow of water down the Illinois River. We think it ought to be put away ahead of any power company located at Niagara Falls. It is not within our province to suggest the limit to be put upon the water to be diverted at Niagara, but we think you ought to give us what we need—14,000 cubic feet—and what is left over, divide among the people who are making money out of it, if you will.

Senator BACON. You said something just now about an estimate for a power company. Is not that at Chicago?

Mr. MCCORMICK. No, sir; that is at Niagara Falls.

Senator BACON. You mentioned the two in such close connection that, while I did not interrupt you at the time, I was wondering why there should be any connection.

Mr. MCCORMICK. The engineers, in their suggestion that 28,000 cubic feet be diverted on the American side, propose that 9,500 be allotted to the Niagara Falls Power Company, 8,600 to another company, and 10,000 to the Chicago Drainage Canal, putting all on an equality, which we do not think should be done.

Senator LODGE. What would run the falls dry are those power companies, built and building, right near the falls. I do not believe this canal will have that effect.

Senator MCCREARY. I would like to have you state, Mr. McCormick, the quantity of water already taken from the Niagara River by the private works.

Senator LODGE. Sixty thousand cubic feet.

Senator MONEY. I do not care what you do with the private works. So far as I am concerned, you could stop them all to-morrow and condemn them for the public benefit. But this thing of cutting off the supply of water at the end which can not affect appreciably that flow at all, which would stop drainage and also stop the plan I have here—I think it should not be done.

Senator LODGE. Then the health of a great community is also involved in this?

Senator MONEY. Yes; that should be put above the gains of a stock company at Niagara Falls. They are not to be considered together in the same season of the year.

Mr. MCCORMICK. We do not want to take 14,000 cubic feet. We do not want to take a foot if we can help it. It is terribly expensive, and we do not want to take any more than we have to take.

Senator MONEY. I appreciate your situation, but I feel a particular and special interest in the transportation routes to Chicago from my State. We have railroads now, but we want to sort of correct and govern the railroads by providing for water transportation.

Senator MORGAN. Mr. McCormick, what is the status of the proposed ship canal between the Allegheny River and Pittsburg?

Mr. MCCORMICK. I believe a corporation has been formed and has been granted certain rights and privileges. I do not know what they are.

Senator FORAKER. That bill has passed the House and has been considered in the Senate Committee on Commerce. I am not sure but what that committee has reported it.

Senator LODGE. What is that?

Senator FORAKER. The incorporation of a company under an act of Congress to build a ship canal from Ashtabula or some point near there down to Pittsburg, making a further drainage of water from Lake Erie, but it will be a lock canal. How much water they propose to take off I do not know.

Senator FRYE. That has been reported and is on the calendar.

Senator BACON. If it is a lock canal, it will not take out much water.

Senator MONEY. If it is a lock canal, it has to have feeders along the route.

Senator FORAKER. It does have feeders. I think it mentions a lot of tributary streams.

The CHAIRMAN. As we have not much time left, perhaps we had better let Mr. McCormick get through.

Senator FORAKER. This is very interesting, and I think it is a very important subject. We can keep these gentlemen here until we get through.

Mr. MCCORMICK. That is all I have to say. I want to call the attention of Senator Money to the fact that his ship canal would not be possible if it were not for the drainage canal.

Senator MONEY. I understand that. Mine, however, is not a ship canal. It is for water transportation. I know very well the effect your scheme has upon it, but it is simply an enlargement of your benevolent scheme for health, to give us cheap transportation in the southern part of the Mississippi Valley.

Senator FORAKER. Will not 22 feet be enough for you, Senator?

Senator MONEY. Certainly it will.

Senator FORAKER. I understand that is the present depth.

Mr. MCCORMICK. We have 22 feet in the Chicago Drainage Canal. After we get out in the Illinois and Mississippi rivers we have no connection with that.

Senator MONEY. That is all right, as far as the canal goes, but the amount of water that is sent from the western end of the canal may not be sufficient to fill the Illinois River. That varies in depth and width and has all the incidents to any stream, silt bearing and liable to deposit silt, which is held in suspension one day and then taken away and shifted about.

Senator MORGAN. Have the works at Niagara, driven by water, reduced the level of the lake or lakes to any perceptible degree?

Mr. MCCORMICK. I do not know, sir. That is away off from our part of the country.

Senator LODGE. They have reduced the flow of the Falls 33 per cent.

Mr. MCCORMICK. Mr. Randolph can answer that question.

Senator MORGAN. I just wanted to know whether it had been demonstrated that the works there have reduced the level of the Falls at all; and if so, how much.

The CHAIRMAN. Mr. Randolph, gentlemen, is a very eminent engineer and is familiar with the facts. We will now hear him.

STATEMENT OF ISHAM G. RANDOLPH, ENGINEER IN CHIEF OF THE CHICAGO DRAINAGE CANAL.

Mr. RANDOLPH. Mr. Chairman and gentlemen, I will either talk right along and tell you my story, or answer questions, whichever you prefer.

Senator MONEY. Tell your story first.

The CHAIRMAN. Yes; that will be better.

Mr. RANDOLPH. The Sanitary District Canal in Chicago is the outcome of its necessities. The water supply of Chicago is taken from Lake Michigan. For many, many years its sewage was discharged into its drinking reservoir. This created a condition of health in Chicago which was deplorable. The Chicago River was an open sewer, which stank to heaven. The flow from the river, when it had any flow, was into the lake. It was merely a ditch into which the water came as the lake rose and fell with the winds, with flood waters in flood times dragging all the sewage out into the lake. The intakes for the Chicago water supply were placed 4 miles in the lake, and floods drove the polluted waters of the river out to those intakes and they were sucked back again into the water supply.

This condition of things became so unbearable that as far back as 1885 a commission was appointed to determine what should be done to relieve Chicago. Mr. Rudolph, of Philadelphia, was the head of that commission. His associates were Mr. Benjamin F. ———, Mr. Samuel ———, and Mr. R. E. Cooley. These gentlemen gave the whole subject-matter very exhaustive study and made a report which, unfortunately, never saw the light in print. It was many years before I had access to anything which gave me any idea of what they had reported, but I finally got hold of one of their preliminary reports, which showed that they at first considered the propriety of putting a great intercepting sewer, in which would collect in the waters of the Chicago River all the sewage of Chicago and convey it

to the southeast, where it would be dumped into the lake, and at the southern extremity of the lake.

Senator MORGAN. Of Lake Michigan?

Mr. RANDOLPH. Yes, sir. The intakes were all to be removed to the north of the Chicago River, so as to divorce the source of pollution and the source of supply as far as possible. An alternative to this was the same intercepting sewer with a great irrigation farm, in which all this sewage was to be dumped.

The cost of that proposition was about $75,000,000, and the annual cost of maintenance was $2,000,000.

The third alternative was the reversal of the flow of the water of the river, discharging its waters into the Desplaines River in the vicinity of Lockport.

The result of this agitation was that in 1889 what is known as the sanitary-district law was passed by the State of Illinois. This provided for the formation of sanitary districts. It was a general law, although it was well known when it was passed that it would have but one feasible application, and that would be for the city of Chicago. This law provided for the cutting of the channel from Chicago, the reversion of the flow of the Chicago River, and discharging its waters into the Desplaines River.

At that time the cross section of the Chicago River was only sufficient to accommodate a flow of about 150,000 cubic feet per second. Its channel was designed for a flow of 600,000 cubic feet per second. The supply of this channel had to be through the Chicago River. Therefore this improvement was imperative.

The plan adopted was to widen that river to 200 feet and deepen it to 26 feet. That improvement has gone ahead until it is now within about 25 per cent of completion. One bar to its completion is the existence of the three tunnels crossing the river, whose depth is only about 17 feet. They allow navigation of only 17 feet.

Even that cross section, under the restrictions placed upon it by the Secretary of War, provided for a flow of only 480,000 cubic feet per minute at a velocity of 1¼ miles per hour. To get the other 120,000 a conduit was built across the city on the line of Thirty-ninth street. That conduit has to be supplied by pumping. The pumping plant is nearly completed. It will be in operation about the 1st of August. In that plant there are four pumps for pumping sewage and two pumps for pumping the flow of water. These are the largest pumps ever seen by man. Each pump will throw 40,000 cubic feet of water per minute.

Senator MONEY. How many gallons is that?

Mr. RANDOLPH. That is 300,000 gallons a minute. So for the Chicago River and the sewage that pours into it provision is made for diverting it all from the lake by intercepting sewers running along the lake front, both north and south, those on the north running to an intercepting sewer on Lawrence avenue, where it will be pumped into the north branch of the Chicago River, come down, and be pumped into the main branch and flow south. But that does not relieve the southern portion of the city and its suburban neighbors, which lie on the south of the zone which will be affected by the works we have projected. The Calumet region is fast settling up. It is going to be a populous and a sewage-creating community. That sewage now discharges into the Calumet River. It is just as neces-

sary for the protection of the health of Chicago that the Calumet River should be diverted as that the Chicago River should be diverted. At the last session of the legislature a bill was introduced authorizing the diversion of the Calumet River. That diversion is shown in the dotted red line upon the map.

To carry out what is necessary for Chicago's health it requires 10,000 cubic feet of water per second through the Chicago River, and it will require 4,000 cubic feet per second through the Calumet River, giving a combined flow of 14,000 cubic feet per second.

The work of the district, while primarily for sewage purposes, has provided the finest artificial waterway which man has yet built. The standard cross section of that channel is 200 feet wide on the bottom. Its minimum depth of flow is 22 feet. It varies from 22 to 24 or 25 feet, according to the stage of the lake. Its width at the water surface is 290 feet, with a minimum depth of 22 feet.

The CHAIRMAN. Is it that wide through the rock?

Mr. RANDOLPH. No, sir; when we come to Willow Springs we strike the rock section, which is 14.95 miles long. There the sides of our channel are vertical. They are cut with channeling machines through the solid rock, and where the solid rock is overlaid by earth masonry, walls are built to a height of 5 feet above Chicago datum. Chicago datum is the low water of 1847. There was a plane of reference established by the engineer who built the old Illinois and Michigan Canal, and it so happened that it coincided with the low water of 1847, and is always spoken of as the low water of 1847. The dimensions of the rock channel were such that it had a capacity for about 850,000 cubic feet of water per minute flow. So we took in the rock channel the 4,000 additional cubic feet which we asked for the Calumet region.

Senator MORGAN. Four thousand cubic feet per second?

Mr. RANDOLPH. Four thousand cubic feet per second. We asked for that improvement.

Senator BACON. Let me ask you a question without interrupting you. You say it has a minimum depth of 22 feet?

Mr. RANDOLPH. Yes, sir.

Senator BACON. That is, with the present flow of water, less than 5,000 feet per second?

Mr. RANDOLPH. No, sir; there is a hydraulic condition there which gives you a greater depth with a small flow than you have with a large flow. As you increase the flow, you increase the hydraulic slope. At the present time, with our small flow, the hydraulic slope is much less than the bottom. Consequently the depth is not much greater with the large flow than with the small flow.

Senator BACON. The current would be more rapid?

Mr. RANDOLPH. The current would be more rapid with the large flow.

At the present time we are extending this channel from Lockport 4 miles. There is a drop, 2 miles below our present end of the channel, of 34 feet. There we are putting in a lock so as to continue the navigation over the old Illinois and Michigan Canal. We hope and believe that the Government will carry on what we have commenced. This waterway through the Illinois Valley has been talked of for many, many generations. There has been a project which has been looked for and hoped for. The great obstacle has been cutting

through the divide between the watershed at Lake Michigan and the Illinois Valley. We have cut through that divide. We have made the waterway possible. Our channel is equipped with movable bridges. The law under which we operate requires us to equip those bridges and open the channel to navigation in 1907. So that after those bridges are equipped with operating machinery—they are built to operate now; it is simply the operating machinery that is required—any vessel which floats in Lake Michigan can go down to the end of our channel, 36 miles.

Senator LODGE. And there it joins the Illinois River?

Mr. RANDOLPH. And there it joins the Desplaines River. Then 20 miles farther the Desplaines unites with the Kankakee and forms the Illinois River.

Senator LODGE. How much water have you in the Desplaines River?

Mr. RANDOLPH. The Desplaines River is a fluctuating stream. In some seasons the flow is so small that it will pass through a 6-inch pipe; at other times it is a roaring torrent and carries 800,000 cubic feet a minute.

Senator BACON. That is not true, with respect to a 6-inch pipe, of this channel?

Mr. RANDOLPH. Oh, no, sir; the channel and the Desplaines River do not unite until they get to Lockport.

Senator BACON. I did not know that.

Mr. RANDOLPH. The highest point in the divide between the watershed at Lake Michigan and the watershed at the Illinois Valley was 11.32 feet above the Chicago datum.

Senator FORAKER. Will not the emptying out of the drainage canal into the Desplaines River increase the volume in the Desplaines?

Mr. RANDOLPH. Yes; from where they come together.

Senator FORAKER. Sufficiently to partly overcome the difficulty of navigation?

Mr. RANDOLPH. That could not be navigable without locks, because the declivity is so very great. It will be necessary to put locks in there.

Senator FORAKER. Has there been any estimate of the cost to improve the Desplaines?

Mr. RANDOLPH. Yes, sir; there has been an estimate of the cost of improving the Desplaines and Illinois rivers.

Senator MONEY. What is the distance between the Desplaines and the Illinois River?

Mr. RANDOLPH. The distance is about 20 miles.

Senator MONEY. That would have to be canalized, would it not?

Mr. RANDOLPH. Yes, sir. The Illinois is formed by the Desplaines and Kankakee rivers together.

Senator LODGE. The Desplaines River is not now navigable, is it?

Mr. RANDOLPH. No.

Senator FORAKER. How far is it from the junction of the Kankakee and the Desplaines to the Mississippi River?

Mr. RANDOLPH. It is about 290 miles, I think.

Senator LODGE. Is the Illinois navigable?

Mr. RANDOLPH. The Illinois is navigable for boats drawing 5 feet of water.

Senator BACON. You speak of that as the river distance?

Mr. RANDOLPH. That is the river distance.

Senator FORAKER. You said an estimate had been made of the cost of improving the Illinois and the Desplaines rivers down to the Mississippi. Can you tell what that amounts to?

Mr. RANDOLPH. Yes, sir. Something over two years ago Congress passed a bill authorizing a survey of that river with a view of making a navigable channel to connect with the Sanitary District Canal. I have seen an advance copy of that report. It will soon be in the hands of Congress. The estimate for improving the Illinois River from the end of our channel to Grafton is twenty-one million five hundred and odd thousand dollars. The total estimate for carrying a navigable channel through to St. Louis is thirty-one million and some hundred thousand dollars. I don't remember the fractions.

Senator MONEY. When did you see that?

Mr. RANDOLPH. I have seen an advance copy of it.

Senator FORAKER. He says it will be in the hands of Congress in a short time.

Senator MONEY. But I wanted to know when he saw it.

Mr. RANDOLPH. The State of Illinois, at the last session of the legislature, instructed the governor to appoint a commission, known as the "internal improvement commission," to take up this question of waterways and see what could be done in conjunction with the Government or any other body for this improvement. The governor has appointed that commission, and I have the honor of being the chairman of the commission. So it now interests me very materially.

Senator LODGE. With your drainage canal running to the Desplaines, that, of course, gives the Desplaines a larger flow of water?

Mr. RANDOLPH. Yes.

Senator FORAKER. How many locks will be necessary from where you reach the Desplaines down to its junction with the Kankakee?

Mr. RANDOLPH. I think this report calls for 11 locks—not at the junction of the Kankakee, because you would have to canalize the Illinois River down as far as Utica. Then from Utica on you have 227 miles. No locks are necessary in that stretch. It can be deepened by hydraulic dredging.

Senator FORAKER. How far is Utica below the junction?

The CHAIRMAN. It is not more than an inch a mile on the Illinois River.

Senator FORAKER. But he spoke of this estimate covering the improvement of the Illinois River. I understood from your remarks that it did not cover the expense of locks on the Desplaines River.

Mr. RANDOLPH. Yes, sir; the estimate covered everything from the end of our channel through to Grafton.

The CHAIRMAN. Just about an inch a mile?

Mr. RANDOLPH. Yes, sir; just about an inch a mile from Grafton.

Senator FORAKER. Where is Grafton?

Mr. RANDOLPH. Where the Illinois River comes into the Mississippi; and the proposition of the commission is to build a dam at Alton, on the Illinois side of the river. The project was worked up very closely to an approximate estimate we made on it ten years ago—a little bit less than our approximate estimate.

The CHAIRMAN. Now, give your attention a little to the question of this water that is necessary to be taken from Niagara Falls and what effect you think it will have.

Senator MONEY. Mr. Chairman, if you will allow me right there. I object to using that term—taken from the Niagara Falls. It is not taking it from the Niagara Falls.

The CHAIRMAN. I do not know whether or not that is true, but that is the allegation.

Senator MONEY. I know; but it is misleading.

Senator BACON. We might insert the word "alleged" before it.

Senator MONEY. How much taken from the Lakes? That would be proper.

Senator FORAKER. And what is the effect on Lake Michigan?

Senator MONEY. Yes; on the whole system of lakes down as far as the Niagara River.

The CHAIRMAN. Mr. Randolph knows what we mean when we speak of the Niagara Falls.

Senator MONEY. I know; but it is misleading. It gets in the newspapers and creates an impression in the public mind that we are robbing Niagara Falls for this canal. If you stop the use of the water by the private companies there will be no complaint of this thing at all.

Mr. RANDOLPH. You would never hear of this thing. Senator, some years ago Michael Hillcock, who was the commissioner of ways and communications in Russia, went over this work one day, and with him was the Russian consul at Chicago. This was some years before we opened the work. When we got through, this Russian consul said:

> Well, I am very glad to have seen this, because I have spent the summer in Canada and they have been inveighing against this drainage canal, and showed me how much it lowered the lake. They proved to me it lowered it 2 feet.

That was three years before we opened the channel.

The CHAIRMAN. You had not used any water at all?

Mr. RANDOLPH. No water at all. So they were getting ready then to make the howl.

As I said before, when we are taking 600,000 cubic feet per minute, we are only taking 4½ per cent of the flow which passes through the St. Clair River, and it seems to me impossible that that should have any appreciable effect upon Lake Michigan. I made some calculations on this subject some years ago, and if I had had my wits about me, I would have gathered them up before I left home, but I have so many figures to deal with that I can not begin to carry them all in my mind. If you care to have me look up those things, I can forward them to you.

The CHAIRMAN. We would be glad to have them inserted in this testimony.

Mr. RANDOLPH. I will look up those things as soon as I return to Chicago.

Senator MONEY. Mr. Randolph, if you are ready for a question, I would like to ask you in regard to the capacity of those pumps you spoke of. When you say 300,000 gallons per minute, do you mean the plant or one pump?

Mr. RANDOLPH. One single pump.

Senator MONEY. And there are six pumps?

Mr. RANDOLPH. No; there are two that throw that amount. Then there are two which throw only 75,000 cubic feet per second.

Senator MONEY. Which are the two water pumps?

Mr. RANDOLPH. Those that throw 300,000 gallons.

Senator MONEY. Will you permit me to make a suggestion to you?

Mr. RANDOLPH. Certainly.

Senator MONEY. You know your business a great deal better than I do, but if you would transfer your observations of the St. Clair to the Niagara River, and see what effect the outtake of your drainage system has upon the flow in the Niagara instead of the St. Clair, I think it would be a more accurate estimate, because it would come nearer showing what damage was done. That body of water has to go through evaporation in Lakes St. Clair and Erie before it gets down to Niagara. If you get the flow of cubic feet per second in the Niagara River instead of the St. Clair, and compare it with that, it would give, I think, a correct idea of the extent to which it would really affect it, if it affects it at all.

Mr. RANDOLPH. My impression is that the flow of the Niagara River at the natural bridge is 222,400 cubic feet per second.

Senator FORAKER. About the same as the St. Clair, then?

Mr. RANDOLPH. Very nearly. You see, there are very few inflowing streams between.

Senator MONEY. And they are balanced by evaporation?

Mr. RANDOLPH. Yes.

Senator MONEY. That is an important fact to know, I think.

Senator FORAKER. Yes. I should think you would have to take into consideration the evaporation over the whole of that area from Chicago around to Niagara; and also, as an offset to that, the inflow from these tributary streams.

Senator MONEY. Oh, yes.

The CHAIRMAN. If this proposed navigable waterway to the Mississippi River and on to St. Louis should be constructed, how much additional flow of water would that make necessary?

Mr. RANDOLPH. The report of this Commission shows that the flow of 10,000 cubic feet per second is ample for a channel of 14 feet depth.

Senator MONEY. That would be all that would be required, too.

The CHAIRMAN. It does not require a very great amount of water above what you have here estimated.

Mr. RANDOLPH. But I hope, Senators, you will all stand for making the lock sills at least 20 feet deep to provide for anything that may happen in the future. It would not add very much to the cost.

Senator MORGAN. You require for the drainage canal now 10,000 cubic feet per second?

Mr. RANDOLPH. That is what we require for the Chicago project proper through the Chicago River.

Senator MORGAN. And 4,000 for the Calumet?

Mr. RANDOLPH. Yes, sir.

Senator MORGAN. Is 14,000 the total for the drainage business?

Mr. RANDOLPH. Yes, sir.

Senator MORGAN. And the question, of course, is how much that will lower the lake.

Mr. RANDOLPH. Yes, sir.

Senator MORGAN. Lake Michigan is how long?

Mr. RANDOLPH. I think it is 300 miles from the lower end of the lake to Mackinac.

Senator MORGAN. What is the average breadth?

Mr. RANDOLPH. About 62 miles.

Mr. MORGAN. What is the average depth in it?

Senator BACON. Nine hundred feet, is it not? I am guessing at it.

Mr. RANDOLPH. I think it is more than that.

Senator MORGAN. You might as well talk about lowering the Atlantic Ocean by taking 14,000 cubic feet per second out of it as to talk of lowering Lake Michigan. I want to know this: Here are some works that have been put in at Niagara and some are proposed to be put in.

Mr. RANDOLPH. Yes, sir.

Senator MORGAN. Have some of those works that have been put in at Niagara, according to the engineers, lowered Lake Michigan a fraction of an inch?

Mr. RANDOLPH. No, sir; those works have not affected Lake Michigan in any way.

Senator MORGAN. It seems to me that would settle the question.

The CHAIRMAN. That is true so far as we are concerned, but the question is in regard to lowering Niagara by the use of water by these manufacturing establishments.

Senator MONEY. That is right at the spot.

The CHAIRMAN. It is nearly 12 o'clock. Have you finished your statement, Mr. Randolph?

Mr. RANDOLPH. I am about through. I am ready to answer any questions, provided I am able to do so.

Senator MCCREARY. I want to ask Mr. Randolph a question. I noticed in the report of the engineers the statement that the total quantity of water to be taken from the Niagara River by works now authorized is 60,000 cubic feet. You are familiar with this report?

Mr. RANDOLPH. Yes, sir.

Senator MCCREARY (reading):

> Of this amount 26,700 cubic feet is to be taken on the American side and the remainder, 34,200 cubic feet, on the Canadian side—that is, 27 per cent of the average discharge and 33 per cent of the low-water discharge of the Niagara River will cease to pass over the falls when these works are completed and in full operation.

Then it says:

> The water taken on the Canadian side below the crest of the rapids will affect the horseshoe fall alone. If all that taken on the American side should affect the American fall alone, it would practically leave it dry.

I desire to hear you on that point.

Mr. RANDOLPH. That is an impossible condition. The water is taken on the American side considerably above where the divide comes, where Goat Island divides the two falls; so that it is simply a supposition that if this thing should happen the American falls would go dry.

Senator MCCREARY. What appreciable effect at present has the construction of these various works had upon the volume of water passing over the falls?

Mr. RANDOLPH. The works on the Canadian side are not yet completed. There are only two of them in partial operation, so that we have had no opportunity to see what actual operation does effect.

Senator MCCREARY. Can you give an opinion? Have you made an estimate as to what effect these works already finished have upon the falls?

Senator MORGAN. Let me ask you this: Was not that drainage canal in Chicago built entirely by contract?

Mr. RANDOLPH. Yes, sir; entirely.

Senator MORGAN. By contracts let for the length of a mile?

Mr. RANDOLPH. It was divided up into sections approximately a mile in length, and one contracting firm had 5 miles—five sections. That is the largest contract.

Senator MORGAN. Neither the city of Chicago nor the State of Illinois undertook to do the work?

Mr. RANDOLPH. No, sir.

Senator MCCREARY. Mr. Randolph, that is the only question I desire to ask you. If you can make any statement to the committee as to what effect the completion of these works will have on the water passing over the falls I would like to know it.

Mr. RANDOLPH. I am satisfied, from my observation there, that there would be an appreciable diminution of the flow.

Senator MCCREARY. An appreciable diminution?

Mr. RANDOLPH. Yes, sir. On both the American side and the Canadian side there is a long stretch of very shallow water approaching the falls. I think that shallow water would be reduced so as to leave that bare. The great volume would go right into the fairway of the gulch.

Senator MCCREARY. So that the works already constructed are already interfering with the quantity of water that passes over the Niagara Falls, and when completed it will be very appreciable?

Mr. RANDOLPH. Yes, sir.

Senator CLARK, of Montana. Would it not detract very largely from the grandeur and beauty of the scenery?

Mr. RANDOLPH. Yes, sir.

Senator LODGE. How much would the flow be increased by the abolition of the tunnels in the Chicago River?

Mr. RANDOLPH. The flow through our channel?

Senator LODGE. Through your channel.

Mr. RANDOLPH. It would enable us to complete our cross section and give us the 480,000 which we want to get through that branch.

Senator LODGE. It would increase the flow?

Mr. RANDOLPH. Yes, sir.

APPENDIX.

Data concerning the Great Lakes.

[Furnished by Mr. Randolph.]

	Superior.	Michigan.	Huron.	St. Clair.	Erie.
Length of steamer track.....miles..	383	321	220	17	237
Breadth.....do....	160	118	101	24	57
Area of water surface.....square miles..	31,800	22,400	23,200	445	9,932
Area drained.....do....	48,600	45,700	52,100	6,335	24,480
Total area of basin.....do....	80,400	68,100	75,300	6,780	34,412
Depth, maximum, recorded by lake survey..feet..	1,012	870	750	.....	210
Rainfall, average yearly.....inches..	28	33	32	35	36
Mean surface above tide at New York City (average 45 years, 1860–1904).....feet..	602.29	581.35	581.40	.....	572.61
Mean level above next lowest lake.....do....	20.89	.....	.....	.....	326
Discharge per second.....cubic feet..	75,000	(a)	(a)	208,600	215,000
Increase discharge for each 1-foot rise....do....	15,500	(a)	.....	.....	23,000
Discharge of St. Clair River, per second..do....	206,400	.....	.....	.....	.....
Detroit River.....do....	208,600	.....	.....	.....	.....

a Not known.

The foregoing tables are collated from Bulletin No. 15, Survey of Northern and Northwestern Lakes, United States Engineer Corps, dated April 15, 1905. From the table of discharges it is evident that of the total volume of flow entering the St. Clair River (206,400 cubic feet per second) 131,400 cubic feet must be effluent from Lakes Huron and Michigan. The water areas of these two lakes vary only 800 square miles, but the watershed of Lake Huron is the greatest by 6,600 square miles.

The rainfall of Lake Michigan, however, is greater by 1 inch per annum than that of Lake Huron, hence a guess that 45 per cent of the increased flow over the discharge from Lake Superior comes from Lake Michigan and 55 per cent from Lake Huron seems consistent with the probabilities. Taking the area of Lake Michigan as given, 22,400 square miles, and assuming that rainfall, inflow, and evaporation were alike suspended, we find that with a withdrawal of 14,000 cubic feet per second 1.41 years would be required to lower the lake 1 foot.

This calculation is: Area 22,400 square miles multiplied by 27,878,400 square feet (area of 1 square mile) equals 624,476,160,000 cubic feet for 1 foot of depth. The withdrawal for one year at the rate of 14,000 cubic feet per second is 441,504,000,000 cubic feet, which, used as a divisor, gives 1.41 years, as above. The distance from Chicago to Buffalo by lake routes is 890 miles.

The Niagara River drops 38.06 feet in the first 22 miles of its length, ending at Schlosser's dock; from there to the crest of the falls it drops 48 feet.

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